MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

BDS4614 – MANAGEMENT DECISION SCIENCE

(All sections/Groups)

6 JULY 2023
9.00 a.m – 12.00 p.m
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **7** printed pages excluding the cover page, with **5** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1

Agro Farms is into organic farming and has 200 acres of farmland in Peninsular Malaysia which are suitable for cultivating crops X1, X2, and X3. The costs for cultivating crops X1, X2, and X3 are RM45, RM50 and RM35 per acre respectively. Agro Farms has a maximum of RM20,000 as funds for crop cultivation. Crops, X1, X2, and X3 require 20, 30 and 15 hours of labour per acre respectively, and the maximum number of labour hours available are 4,200. The farm expects to make a profit of RM60, RM80 and RM50 per acre on crops X1, X2 and X3 respectively.

The Final Simplex Tableau for the above problem is given below:

		60	80	50	0	0	0	
Cj	Solution Mix	X1	X2	X3	S1	S2	S3	Quantity
50	X3	0.667	0	1	2	0	-0.0667	120
0	S2	5	0	0	-20	1	-1	11,800
80	X2	0.333	1	0	-1	0	0.0667	80
	Zj	60	80	50	20	0	2	12,400
	Cj-Zj	0	0	0	-20	0	-2	

S_1 – Slack for the farmland available
S_2 – Slack for the budget constraint
S_3 – Slack for the labor hours available

a) Formulate the above as a linear programming problem. (4 marks)

b) Set up the Initial Simplex Tableau for the above problem. (2 marks)

c) Based on the Final Simplex Tableau given above, state the optimal mix and the associated maximum profit? (2 marks)

d) Should Agro Farms increase the budget for crop cultivation or increase the labour hours? Why? (3 marks)

e) If Agro Farms were to hire an additional worker for 20 hours at RM1.5 per hour, how much additional profit would it make, if any? (2 marks)

f) Over what range can the maximum labour hours vary within which the current shadow price remains valid? (3 marks)

g) Determine the range of optimality for the profit contribution of the crop X_2. (4 marks)

(Total: 20 marks)

Continued...

QUESTION 2

a) Smart Technology sells tablets to universities in Malaysia. It can supply tablets to universities from its Perak, Penang, Selangor, and Johor warehouses. The shipping costs per tablet from each warehouse to each university, supply at each warehouse and demand at each university are presented in the following table:

Warehouse	University				Supply (units)
	I	II	III	IV	
Perak	37	32	52	52	400
Penang	50	53	41	38	400
Selangor	28	48	39	43	400
Johor	47	44	48	54	300
Demand(units)	300	350	450	200	

i. Determine the initial solution using VAM method and find the least cost schedule using MODI method. What is the total minimum shipping cost?

(8 marks)

ii. Is there any alternate optimal solution? Why? If yes, determine the alternate optimal solution.

(2 marks)

b) In a customer service centre, four staff are to be assigned to handle four service counters. The four service counters are designed to solve different customer problems. The customer satisfaction rating (1-10) of each of the staff at each counter is listed in the following table:

Staff	Machine			
	W	X	Y	Z
Dinesh	7	6	7	9
Michael	8	7	9	8
Nurul	9	8	9	7
Syukri	7	7	8	9

Determine the best assignment plan that maximises the total customer satisfaction rating.

(10 marks)

(Total: 20 marks)

Continued...

QUESTION 3

The Farmer's American bank of Leesburg is planning to install a new computerized accounts system. Bank management has determined the activities required to complete the project, the precedence relationships of the activities, and activity time estimates, as shown in the following table.

Activities	Predecessors	Time estimates		
		Optimistic	Most realistic	Pessimistic
A	-	5	8	17
B	-	3	12	15
C	A	4	7	10
D	A	5	8	23
E	B, C	1	1	1
F	B, C	1	4	13
G	D, E	3	6	9
H	D, E	1	2.5	7
I	H	1	1	1
J	F, G	2	2	2
K	G, I	5	8	11

a) Draw a network diagram to represent the project. (5 marks)

b) Compute the expected time and the variance for each activity time. (4 marks)

c) Determine the earliest starting time, earliest finishing time, latest starting time, latest finishing time and critical path. (5 marks)

d) Obtain the expected completion time for the project. (2 marks)

e) Calculate the variance in the expected completion time for the project. (2 marks)

f) What is the probability that the project can be completed in 40 weeks or less? (3 marks)

(Total: 20 marks)

Continued...

QUESTION 4

Jaya Stationery shop sells Acrogel pens and the annual demand for the Acrogel pens is 3,000 units. The shop's current policy is to order 400 units of Acrogel pens each time an order is placed and the lead time for receiving the order is 3 days. The pen cost RM2.50 each while the annual holding cost for the inventory is 6% of the unit cost and the ordering cost is RM20 per order. The shop is open for business for 250 days a year.

a) What is the total inventory cost associated with the current policy? (4 marks)

b) If Economic Order Quantity model is used,
   i) What is the optimal order policy? (2 marks)
   ii) What is the cycle time? (2 marks)

c) What is the reorder point? (2 marks)

d) If the supplier offers a discounted price of RM2.10 for each Acrogel pen for order quantity of more than 600 units of pens, should the shop take advantage of the offer. If so, what is the optimal order quantity? What is the total annual inventory cost? (10 marks)

(Total: 20 marks)

QUESTION 5

Mr. Chan, the manager of a commercial bank loan department, must decide on allocation of loans. He can choose strategy A, strategy B or not to provide any loan. The profit (RM) from each alternative depends on the economic conditions in the following table:

Alternative	Economic Condition, Profit (RM)		
	Good Economy	Average Economy	Poor Economy
Strategy A	265,000	125,000	30,000
Strategy B	400,000	190,000	-50,000
No loan	0	0	0

a) Determine the best investment using the following decision criteria:

   (i) Maximax (2 marks)

   (ii) Maximin (2 marks)

Continued ...

(iii) Equally likely criterion (3 marks)

(iv) Criterion of realism, using $\alpha = 0.6$ (3 marks)

(v) Minimax regret criterion (4 marks)

b) For the data in part a), Mr. Chan estimates the probabilities of a good market, average market and poor market are 0.4, 0.5 and 0.1 respectively.

(i) Construct an expected opportunity loss (EOL) table. (4 marks)

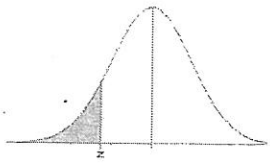
(ii) Using minimum EOL as the decision criterion, determine the best decision. What is the minimum EOL? (2 marks)

(Total: 20 marks)

End of Paper

Standard Normal Cumulative Probability Table

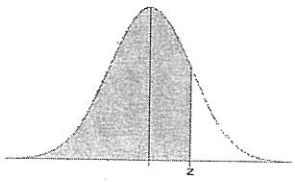
Cumulative probabilities for NEGATIVE z-values are shown in the following table:



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Standard Normal Cumulative Probability Table

Cumulative probabilities for POSITIVE z-values are shown in the following table:



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998